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Environmental enrichment for grey seals (*Halichoerus grypus*) in captive environment

Wzbogacenia środowiskowe dla szarytek morskich (*Halichoerus grypus*)
utrzymywanych w warunkach hodowli zamkniętej

Summary. Grey seal (*Halichoerus grypus*) is one of the most popular marine mammals found in the Baltic Sea and North Atlantic. It is protected worldwide because of an important role it plays in the ecosystem along with other marine predators, also because it is an indicator. It arouses both the sympathy and aversion of the public opinion, probably caused by insufficient knowledge about this species. Due to the high adaptability, captive individuals adapt easily to the artificial environment, but this does not exempt them from the necessity of providing them with the comfort of living in closed conditions. The study concerns the design and application of environmental enrichments for grey seals living in zoos. They aim to improve the welfare of those animals which, by living in small enclosures and impoverished environment, are not able to display the full range of species behavior. Stimulation with new elements is also important in preventing aggression, apathy, and stereotypies. The proposed enrichments are easy to implement and relatively low-cost, intended for use in zoos and other organizations or institutions keeping specimens of this species. The results of the preliminary observation showed that grey seals reacted positively to some of the proposed enrichments and the time of expressing the food behavior has extended. Further issues require additional and more detailed observations.

Key words: gray seal, *Halichoerus grypus*, environmental enrichment, stereotypies, animal welfare

INTRODUCTION

The grey seal (*Halichoerus grypus*) is one of the most popular marine mammals found in the Baltic Sea and North Atlantic. It is protected all over the world because of

the important role it plays in the ecosystem, also because it is an indicator. In the Red List of Threatened Species published by the International Union for Conservation of Nature (IUCN), the grey seal is listed as the species of least concern. Its population is growing to approximately 316,000 mature individuals, and the total abundance is approximately 632,000 [IUCN 2019]. International protection over *H. grypus* is covered by the Berne Convention (in Appendix III), the Bonn Convention (in Appendix II), and the Helsinki Commission (HELCOM). Due to their high adaptability, captive individuals adapt easily to the artificial environment [Kaleta 2014a, Kroshko 2015]. However, this does not mean that we can forget about enriching its environment in captive conditions.

In Poland, this species is under strict and active protection, the best example of which is the Marine Station of the Institute of Oceanography of the University of Gdańsk in Hel. This institution saves individuals in need of assistance, monitors the Polish population, and researches it [Gójska and Pawliczka 2012]. Until recently (to date 2019), individuals kept there permanently were allowed to breed, and the pups were released into the wild. Grey seals are also found in 4 Polish zoos: in Gdańsk Oliwa, Płock, Warsaw and Borysewo. The maintenance of grey seal in Poland requires a minimum area of 60 m² with a swimming pool at least 1.5 m deep and with a land part [Bernacka et al. 2014]. In turn, EAZA (European Association of Zoos and Aquaria) in 2018 provided the following guidelines for the maintenance:

- group size – 1–6 individuals;
- enclosure area – 30 m²;
- additional area for an additional animal – 5 m²;
- pool area – 120 m²;
- additional pool area for an additional animal – 20 m²;
- minimum capacity – 367 m³;
- the minimum depth of the additional pool – 2.5 m [Gili et al. 2018].

Animal welfare is the most important element of animal husbandry and breeding, whether farmed, companion, exotic animals, animals kept in zoos, or various types of shelters. Its low level is characterized by difficult adaptation to stressful situations, reduced growth, and development capacity, the occurrence of bodily injuries and diseases, reduced immunity, self-drug addiction, limitations in expressing natural behavior, and the presence of behavioral pathologies (stereotypies) [Bombik et al. 2013]. In the modern view of the “five freedoms”, we increase the emphasis on the importance of the emotional state because the physical state often results from it. We try to enable animals to live according to the motto “life worth living” [Mellor 2016]. Closed housing will never fully reflect the natural environment. It is difficult to create optimal artificial environmental conditions for wild animals because they have their biological rhythms, specific behavior and preferences, fixed in their genes. Additional stimuli are food change, restriction of living space, and in particular contact with humans. All of this can lead to abnormal behavior by zoo residents, which is a symptom of poor welfare [Kaleta 2014b]. The most effective way to get rid of stereotypes is to enrich the animal’s environment [Kowalski 2005]. Environmental enrichment is a beneficial change of the environment, stimulating the animal’s natural behavior and limiting the atypical one (e.g. to eliminate aggressive behaviors [Tomczyk i Zieliński 2021]). We use it by increasing the animal’s living space,

enriching it with various types of stimuli, providing safety – it may be an exploration of the environment, obtaining food, or affiliate interactions between other individuals.

In nature, grey seals occupy huge areas that are not available in a captive environment, where the possibility of long-term exploration disappears, and this exploration is part of their natural ethogram. Because of this, they quickly become bored and fall into behavioral pathologies.

Therefore, the study aimed to create environmental enrichments for them, which are supposed to diversify the methods of food intake and thus improve the welfare of these animals and enable them to exhibit natural behavior. In Russell's et al. [2015] it was found that it is difficult to clearly define the part of each behavior of these animals (e.g. resting, foraging, reproducing, locomotion, avoiding predators, and caring for younglings), as there is a large variety of behavioral strategies due to seasonal factors (e.g. reproduction, seasonal availability of prey), internal (gender, age) and external (time of the day, space). Lack of competition also affects the time budget.

MATERIAL AND METHODS

In this paper we present the design of 4 environmental enrichments for grey seals which are kept in captivity. Enrichments were developed and constructed based on the authors' previous experience working with gray seals.

The project of environmental enrichments is based on the specific requirements and behavioral needs of the grey seal. In addition to improving welfare and limiting the occurrence of undesirable behaviors, the designed enrichments were to be relatively easy to implement and low-cost. All proposed enrichments should be used in a water reservoir where seals move more efficiently and feel safe. Each object is designed to extend the time of food behavior (searching, eating), encourage the exploration of the inside of the pool, and contact with other animals.

The designed enrichments were used for the initial suitability assessment at the Marine Station of the Institute of Oceanography of the University of Gdańsk in Hel, on a herd consisting of five individuals – three females and two males. They were placed in a pool shortly after the official feeding with medical training when most of the visitors were slowly leaving the facility.

Enrichment no. 1 – the bottle

This enrichment is made of a bottle (18.9 l) from the water dispenser (Fig. 1). A dozen holes were cut in it with a sharp tool, then the edges were smoothed so that the animal could not cut itself. The holes should be such size that the fish easily fall out of the inside of the bottle, but also that the seal would not be able to insert the entire snout (probability of jamming). The animal should turn the bottle freely in the pool and catch fishes that fall out. A large number of holes will make the place, where the delicacy is released, unpredictable – this will increase the motivation to compete between individuals for food.



Fig. 1. Enrichment no. 1 – the bottle [phot. O. Łypik]

On the other hand, if the enrichment floats loosely at the surface of the water, the animals will be forced to manipulate the object from all sides and will involuntarily follow the flowing object, which will extend the time of the meal.



Enrichment no. 2 – the frozen food

The following elements were used to make a bowl, a thick, unbreakable rope, and a brick. The bowl was filled with water and fishes, then the end of the rope was inserted inside and thus frozen. Later the frozen “ice barf” was taken out of the bowl, and the other end of the rope was tied to the brick, which weighed down the entire structure (Fig. 2) so that it was submerged in water. The frozen food tried to rise to the surface of the water, but the tied sinker stopped it in the middle.

Fig. 2. Enrichment no. 2 – the frozen food [phot. O. Łypik]

The enrichment was placed in the pool so that the seals could swim around it and nibble on an ice snack from all sides. Chewing on the frozen pieces is time-consuming and will take them much longer than simply serving a meal. Additionally, to get food, animals must dive and stay underwater for a long time, which reflects searching for food in nature.

Enrichment no. 3 – the drawer with food

This enrichment consisted of installing a formwork block at the bottom of the pool with a basket or a colander filled with food inside. The basket was fitted to the hollow brick and its holes were small enough for the animal to sense the presence of the treatment but could not take it out through the holes (Fig. 3). The seal was able to push the basket out of one side with its mouth so that it slipped out of the block. On the other side,



Fig. 3. Enrichment no. 3 – the drawer with food [phot. O. Łypik]

a rather thick string has been installed, which the animal will pull to pull out the basket. Such enrichment will motivate them to explore – using a perfect sense of smell – the bottom of the pool in which they have to dive for a long time to find a structure with a meal. Moreover, they should be able to solve the task of pulling out the basket.

Enrichment no. 4 – the artificial rushes

Pieces of strings with different thicknesses and lengths were tied together. They were thick enough so the animal would not be able to chew and swallow them. Also, knots have been made on them, for variety. Narrow, rectangular slits were cut in an empty plastic bottle, and then a string was threaded through the entire length of the bottle – from the thread to the bottom – and tied to the other cords so that the bottle hung horizontally (Fig. 4). Fishes placed inside were falling out freely



Fig. 4. Enrichment no. 4 – the artificial rushes [phot. O. Łypik]

through the slits when the bottle was moved. The ropes densely entangled in the water made it difficult for seals to reach their food source. Animals were forced to move the ropes with their noses or grab them with their teeth to change the position of the bottle – just like in nature, where they hunt fishes hiding among plants. This will extend the time of looking for food and awaken their instincts.

RESULTS AND DISCUSSION

Initial observations after the application of the designed 4 food enrichments showed that all of them induced a positive response from the animals. Seals approached new objects with interest in their neighborhood and used them until the food was finished. They spent more time eating that way than by putting meals into a pool or directly into their snouts.



Fig. 5. Enrichment no. 1 during the enrichment session with grey seal [phot.O. Łypik]

In the case of enrichment no. 1 (bottle), the seals approached the object with interest and nudged it with their snouts, competing with each other to catch fish. They had different strategies of pulling out the food: some of them were sucking the fish by placing their snouts over the selected hole and spinning around their axis (resembling a screw) (Fig. 5), and some of them were hitting the bottle with their noses until the treats fell out.

Intrigued by the appearance of hard-to-reach food (e.g. enrichment no. 2 – frozen food, Fig. 6), the individuals began to nibble on the frozen treat, flowing around it and hastily catching the torn pieces that fell to the bottom with their snouts. After a few minutes, the food thawed slightly, which caused it to detach from the rope and float to the surface of the water. The animals helped themselves in consumption, holding the frozen food from time to time with a fin.



Fig. 6. Enrichment no. 2 during the enrichment session with grey seal [phot. O. Łypik]

Environmental enrichments are widely used for animals in captive environment and number of studies on their influence on animal welfare is constantly growing [Alligood and Leighty 2015]. Studies on marine animals' shows that enrichments decreases stress in captive animals and helps to promote natural behaviors [Corcoran 2015, Makecha and Highfill 2018]. Physically enriched aquatic animals generally have better welfare than their barren counterparts. The enrichment type, animal taxon and welfare category are the most important drivers for the high heterogeneity among effect sizes [Alligood et al. 2017, Zhang et al. 2021].

In 2002, Hunter et al. investigated the effect of environmental enrichment on the behavior of harbor and grey seals. Observations included resting in water, haul-out, eating, breeding, mating behavior, aggression, pattern swimming, random swimming, exploration, and time when seals were out of sight. The enrichments decreased stereotypical behavior and seals were less often out of sight, and their level of activity increased signif-

icantly. The amount of time spent exploring increased while the objects were in the pool. This means that enrichment may promote the natural behavior of wild species and may contribute to the behavioral complexity of these captive animals. Swaisgood and Shepherdson [2005] report that enrichment is effective and reduces the frequency of stereotypes in just over half of the cases. A study by Stevens et al [2013] showed that as the number of zoo visitors increases, so does the number of seals submerging underwater. However, it is difficult to say whether this threatens their well-being.

Databases on predatory animals kept in confined conditions indicate that in more than 50% of all registered grey seals, locomotory stereotypies were present, and food behavior took more than 10% of the day [Kroshko 2015]. The problems noticed in the grey seals were, above all, boredom and stereotypical swimming as well as impatience waiting for a meal near the place where it was prepared.

CONCLUSIONS

The preliminary observations allow us to conclude that the grey seals react positively to some of the proposed food enrichments. However, the long-term impact of the above solutions cannot be assessed yet, but only the temporary one, which is certainly the extension of the time of expressing the food behavior. The designed and presented in this paper environmental enrichments motivated captive seals at the Marine Station of the Institute of Oceanography of the University of Gdańsk in Hel to spend more time exploring their surroundings and foraging behavior, as well as solving simple tasks. This will help to reduce inactivity, apathy, and stereotypical behavior, as well as impatience waiting for a meal. To confirm the actual beneficial effect of these enrichments, further observations should be made on a larger scale, in conjunction with the determination of behavioral and welfare indicators of the seals before and during the enrichment (e.g. checking of cortisol levels). Keepers in zoos and other establishments can easily take advantage of these solutions with both low labor and cost. However, despite the lack of empirical data from our initial observations, animal caretakers noted a positive effect. This gives hope for better results in future studies on the behavior of the observed group of seals at the marine station in Hel.

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Streszczenie. Szarytka morska (*Halichoerus grypus*) jest jednym z popularniejszych ssaków morskich występujących w rejonie Bałtyku i północnego Atlantyku. Jest objęta ochroną na całym świecie, ponieważ spełnia ważną rolę w ekosystemie wraz z innymi morskimi drapieżnikami i należy do organizmów wskaźnikowych. Wzbudza zarówno sympatię, jak i niechęć opinii publicznej, wywołaną najpewniej niedostateczną wiedzą na temat tego gatunku. Dzięki wysokiej zdolności adaptacji osobniki utrzymywane w niewoli łatwo przystosowują się do środowiska sztucznego, jednak nie zwalnia to z konieczności zapewnienia im komfortu życia w warunkach zamkniętych.

Praca dotyczy zaprojektowania i zastosowania wzbogaceń środowiskowych dla fok szarych przebywających w ogrodach zoologicznych. Mają one na celu poprawić dobrostan tych zwierząt, które przez pobyt w małych pomieszczeniach i w zubożałym środowisku nie są w stanie przejawiać pełnego wachlarza zachowań gatunkowych. Stymulacja nowymi elementami ma także znaczenie w zapobieganiu agresji, apatii oraz stereotypii. Przedstawione propozycje wzbogaceń pokarmowych są łatwe w wykonaniu oraz stosunkowo niskobudżetowe, przeznaczone do stosowania w ogrodach zoologicznych oraz innych organizacjach lub instytucjach utrzymujących osobniki tego gatunku. Wyniki wstępnych obserwacji wykazały, że szarytki morskie pozytywnie zareagowały na niektóre z proponowanych urozmaiceń, a czas wyrażania zachowań pokarmowych uległ wydłużeniu. Dalsze kwestie wymagają dodatkowych i dokładniejszych obserwacji.

Słowa kluczowe: szarytka morska, *Halichoerus grypus*, wzbogacenia środowiskowe, stereotypia, dobrostan zwierząt

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